

The Interactive Effects of Race and Teacher Self Efficacy on the Achievement Gap in School

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ABSTRACT

This article investigated the interactive effects of race and teacher self efficacy on the achievement gap in math scores for one middle school. A modified teacher self efficacy scale was used to measure the teaching self efficacy of the students' teachers. Two Way Analysis of Variance (ANOVA) procedures showed a main effect for the teacher self efficacy on the students' scores on each benchmark test. Statistically significant interactive effects were found for student ethnicity and teacher self efficacy. The findings showed that students with highly efficacious teachers earned higher test scores than did students with teachers of a low self efficacy. These findings have serious implications for addressing self efficacy's role in bridging the achievement gap in schools.

The Interactive Effects of Race and Teacher Self Efficacy on the Achievement Gap in Schools

In the ever-changing field of public school education, a constant and serious issue is the achievement gap in schools. Decades of research have documented the wide achievement disparities between different groups of students (Ferguson, 2002; Kober, 2001; National Center for Educational Statistics, 2001). A few researchers have attributed this achievement gap to poverty, socioeconomic status, neighborhood characteristics, and other environmental influences (Ferguson, 2000; Tate, 1997; Viadero, 2000). Other scholars (Jencks & Phillips, 1998) have explained the achievement gap through theories on test bias, genetics, and familial and cultural influences. Roscigno's (1998) explanation of the achievement gap lies in teacher expectations, teacher quality, and school characteristics. But the most widely regarded cause of the achievement gap in schools is ethnicity (Kober, 2001; Ogbu, 2003).

To support this hypothesis, researchers point to nationwide ethnic disparities in test score achievement. In most instances, their research showed that in comparison to African-American and Hispanic American students, Caucasian American students are the superior achievers. This trend is evident in the wide disparities between nonminority students' and minority students' graduation rates from schools (Coley, 2003; Gordon, 1999). In other words, ethnicity is the dominant explanatory and predictive variable of the achievement gap in schools. However, we believe that some of the variance in ethnic achievement may be explained by characteristics of the teachers. Thus, this study examined the interactive effects of race and teacher self efficacy on the achievement gap in schools. The particular focus was these variables' influence on the ethnic differences in the benchmark math test scores of 302 middle school students.

The significance of this research is twofold. First, one of the most influential teacher variables is teacher self efficacy (Pajares, 1996; Schunk, 1994). Bandura (1977, 1986, 1995) defined self efficacy as beliefs in abilities to complete desired tasks. He continued that teacher self efficacy influences teachers' commitment to facilitating student achievement. However, scant research existed on the influence of teacher self efficacy on the achievement gap in schools. Second, schools continuously experience an influx of students from various ethnicities (Gay, 2000). The diversity of these populations could presumably create disparities in student achievement. We believe that schools can bridge this gap by examining teachers' sense of self efficacy. Instead, educators must focus on the relationship between the achievement gap and teacher self efficacy. The findings could provide educators with a more holistic view for examining the differences in African American, Caucasian American, and Hispanic American achievement.

Theoretical Framework

This research was shaped by Mitzel's (1960) theory on teaching and learning and Bandura's (1977) Self Efficacy Theory. Mitzel centered the teaching and learning process on presage variables, context variables, process variables, and product variables. He defined presage variables as teacher characteristics. Context variables are student characteristics, and process variables reflect classroom activities. Product variables

describe the outcomes of teaching. According to Mitzel, presage variables and context variables determine the significance of process variables. The interaction of presage, context, and process variables determine the resultant process variables.

Bandura's (1977) Social Cognitive Theory indicates that human achievement is shaped by the interaction of three variables: behavior, personal factors, and environmental factors. According to Bandura, environment provides the cognitive representations that influence person's behavior. Personal factors are self beliefs that facilitate a regulatory measure of control about the behavior. The agentic supposition of this behavioral change is that people can participate in their own development.

We believe that the intersection of these theories can explain the outcomes of this study. In effect, teacher self efficacy and student ethnicity are the presage variables and context variables, respectively, of the classroom environment. The outcomes or product variables are behavioral indications of student achievement. Each classroom will consist of different variations of presage, context, and process variables. From an agentic perspective, teacher self efficacy is a part of the environment that models desired learning behaviors for students. This study examined the extent to which teacher self efficacy (presage variable) and ethnicity (context variable) would show differences in benchmark tests (product variable) for 302 students.

Overview of Research on Teaching Self Efficacy

Bandura (1977, 1986, 1995, 1997) defined teacher self efficacy as a teacher's judgment about the capability to produce desired outcomes in student achievement. He explained that the major influences of teaching self efficacy are mastery experiences, vicarious experiences, and social persuasion.

Mastery experience explains that teaching practices are influenced by previous successful teaching experiences. The vicarious perspective indicates that teachers raise their self efficacy by observing other effective teaching practices. However, if they observe poor modeling of instructional skills, teachers can develop a fear about using the teaching method in their classrooms. Consequently they should receive extensive feedback on how to overcome their fears for teaching. This form of social persuasion can build teachers' confidence to try new and innovative teaching practices.

Bandura (1977, 1997) theorized that these variables collectively add a cyclical dimension to teaching self efficacy. From a repetitive perspective, high teaching self efficacy creates higher confidence for teaching and effective teaching performance. Low teaching self efficacy creates less effort and poor student outcomes from teaching.

These principles are evidenced in Bandura's (1997, 1986) differential descriptions of highly efficacious teachers and low efficacious teachers. According to him, highly efficacious teachers are more likely to use various instructional methods than low efficacious teachers. In addition, research has continuously documented the higher achievement levels for students with highly efficacious teachers (Ashton-Webb, 1986; Coladarchi, 1992; Gibson & Dembro, 1984; Tschannen-Moran & Woolfolk-Hoy, 2001).

Bandura (1977, 1997) and Schunk (1995) also postulated that in comparison to low efficacious teachers, highly efficacious teachers are more likely to persist at risk taking and using teaching innovations in their classrooms. Additionally, teachers with a

high teaching self-efficacy are less critical of student errors and struggling students than teachers with a low teaching self efficacy.

Ross' (1994) study on teaching self efficacy found that highly efficacious teachers were better prepared to:

- Exhibit management strategies that facilitate students' achievement;
- Place continuous emphasis on differentiated instruction for students;
- Inspire students to develop a positive self esteem for learning; and
- Maintain continuous goals for student learning.

Other comparative research has shown that highly efficacious teachers spend more time on planning and organization for teaching (Gibson & Dembro, 1984; Tschannen-Moran & Woolfolk-Hoy, 2001). Simply put, highly efficacious teachers have a stronger commitment to teaching than low efficacious teachers.

We believe that this theoretical overview of teaching self efficacy has significant relevance to this study. In effect, they could explain possible differences between the achievement gap of the participants of this study. If the differences can be somewhat related to either or both teacher self efficacy and student ethnicity, then either or both variables would need additional consideration for studying the ethnic gap in student achievement.

Methodology

Subjects

This study consisted of 302 seventh grade middle schools students. The ethnic population was comprised of 114 (39%) African American students, 89 (29%) Caucasian American students, and 99 (32%) Hispanic American students. Of this same population, 163 (53%) students were taught by highly efficacious teachers. One hundred thirty nine (47%) students were taught by low efficacious teachers. This sample was drawn from a low socioeconomic, high performing middle school in Southeastern Texas.

Instrumentation

The instrument for this study was a modified version of Bandura's (1977) 23-item teacher self efficacy scale (Appendix A). This instrument consists of a 10-item "Instructional" subscale ($\alpha=.87$), 6-item "Management" subscale ($\alpha=.81$), and 6-item "Parent/Community Involvement" subscale ($\alpha=.82$). The "Instructional" subscale measures teachers' beliefs about their abilities to teach all students. The "Management" subscales measures teacher beliefs regarding the ability to create a safe and orderly environment for learning. The "Parent/Community Involvement" subscale entails items regarding the use of parents and school stakeholders to support the classroom. The Likert scale for this instrument ranges from 1-(Low beliefs in my ability) to 5 (Very high abilities beliefs in my ability).

We modified the instrument by placing the term "seventh grade mathematics"

into every sentence. The instrument was validated by a review panel of rural and suburban seventh grade math teachers. Reliability was established by piloting the survey on 20 middle school math teachers. The observed scale scores of the students' teachers ranged from 42 to 102. The resulting scores were either between 42 to 50 or 91-102. Therefore, the students' teachers were classified as either having a high or low self efficacy for teaching.

Outcome Variables

The outcome variables for this study were participants' scores on the three 50-item Texas Assessment of Knowledge and Skills (TAKS) benchmark tests for seventh grade mathematics. These measures were chosen because of the school's huge ethnic disparity in seventh grade math achievement. In addition, they prepare students for taking the official end-of-year standardized mathematics tests. School personnel also use benchmark math test scores to determine how to maximize student success in math achievement.

The first benchmark test measures students' abilities to order and compare integers and whole numbers and change fractions into decimals, and percents. The second benchmark test assesses students' comprehension of estimating and finding solutions to application problems and creating formulas for conversions, perimeter, and area. The third benchmark test measures student mastery of geometry and spatial reasoning. This assessment evaluates students' abilities to compare and classify geometric shapes and solids. In addition, students must apply geometric concepts and principles towards solving mathematical word problems.

Data Collection

At the beginning of the year, we administered the teacher self efficacy survey to the participants' teachers. Afterwards, the teachers began to teach and administer the benchmark tests to students. At the end of the semester, we collected the benchmark test scores from the teachers.

Findings

This section presents the statistically significant main and interactive effects for this study. For ease of reading, one table was used to present the resulting mean scores from statistically significant interaction between the three study variables.

Benchmark Tests

The findings for this study showed statistically significant main effects for teacher self efficacy on students' test scores. In addition, interaction effects were also found for student ethnicity and teacher self efficacy (See Table 1).

Table 1

Statistically Significant Two Way ANOVA Effects for Race and Teacher Self Efficacy on Benchmark Test Achievement

Variable	Benchmark Test One			Benchmark Test Two			Benchmark Test Three		
	Df (Degrees of Freedom)	P	Partial (Effect Size)	Df (Degrees of Freedom)	P	Partial (Effect Size)	Df (Degrees of Freedom)	P	Partial (Effect Size)
Main									
Teacher Self Efficacy	F(2,301) 43.053	.000	.432	F(2,301) 53.053	.000	.461	F(2,301) 63.129	.000	.410
Interactive									
Student Ethnicity & Teacher Self Efficacy	F (3,301) 13.507	.012	.401	F (3,301) 31.042	.000	.424	F (3,301) 23.507	.014	.391

Mean Comparisons

Main Effects

The findings for the first benchmark test showed higher performances for students with highly efficacious teachers (M=81.23; Sd=7.42) than students with low efficacious teachers (M=71.47; SD=9.43). Students with highly efficacious teachers (M=78.90; SD=9.29) also earned higher scores on the second benchmark test did students with low efficacious teachers (M=71.46; SD=8.59). The findings from the third benchmark test revealed higher achievement scores for students with highly efficacious teachers (M=82.09; SD=10.11) than students with low efficacious teachers (M=69.01; SD=11.42).

Two Way Interactive Effects

Two way interactive effects showed that African American, Caucasian American, and Hispanic students with highly efficacious teachers achieved high test scores than did African American, Caucasian American, and Hispanic students with low efficacious teachers (See Table 2).

Table 2

Three Way ANOVA Results for The Interactive Effects of Race, Student Self Efficacy, and Teacher Self Efficacy on Seventh Grade Benchmark Test Scores

Student Ethnicity	Students' Teacher Self Efficacy	First Benchmark Score Mean (SD)	Second Benchmark Scores Mean (SD)	Third Benchmark Scores Mean (SD)
African American	High	83.31 (7.29)	87.00 (8.04)	84.61 (10.59)
Caucasian American	High	82.10 (9.47)	82.03 (7.49)	82.21 (8.75)
Hispanic American	High	77.42 (10.24)	81.42 (12.47)	81.47 (10.03)
Caucasian American	Low	75.31 (8.47)	77.37 (9.24)	75.24 (8.33)
Hispanic American	Low	73.34 (6.39)	74.29 (7.24)	74.01 (7.42)
African American	Low	72.01 (12.39)	71.32 (10.51)	72.29 (13.21)

Discussion

The interactive effects of the study variables impacted the students' benchmark test scores. Ethnic differences were found within each group of students with highly efficacious and low efficacious teachers. These findings support research regarding the achievement gap between Caucasian American students and African American and Hispanic American students (Kober, 2001; Ogbu, 2003). But unlike this research, the findings did not consistently show the highest scores for Caucasian American students. Hispanic American students and African American students earned some of the highest scores on each benchmark test.

The other significant outcome is that these findings are not solely attributable to race. Instead, they were related to race's interaction with teacher self efficacy. The effect

size, however, for this interaction was lower than the effect size for the main effect of teacher self efficacy. Thus, teacher self efficacy appears to be the most significant main or interactive influence on the achievement differences among students. In particular, students with highly efficacious teachers earned higher scores on the benchmark tests than did students with teachers of a low teaching self efficacy.

This outcome is a logical conclusion, given the teacher's unlimited influence on student achievement (McLaughlin, 1986). Numerous researchers (Bandura, 1977, 1986; Gibson & Dembro, 1984; Pajares, 1996; Schunk, 1994, 1995) have indicated that teacher self efficacy has a direct impact on student achievement. This perspective is supported by the outcomes of this research. But the uniqueness of this research is that when considered with ethnicity, teacher self efficacy is still the most influential determinant of student achievement. In addition, this study shows that ethnicity's impact on student achievement is influenced by teacher self efficacy.

Because of the study's sole focus on quantitative statistics, some teacher self efficacy research can not be used to explain the ethnic differences in the benchmark student achievement. Therefore, we use the most applicable research to hypothetical inferences regarding teacher self efficacy's influence on this study. Based on previous research, we suggest that the highly efficacious teachers may have used more instructional methods to teach students than did teachers with a low sense of self efficacy (Ashton-Webb, 1986; Coladarchi, 1992; Gibson & Dembro, 1984; Tschannen-Moran & Woolfolk-Hoy, 2001).

We believe that both groups of teachers encountered difficult learning situations with their students. The highly efficacious teachers, however, may have persisted longer at using risk taking and teaching innovations in their classrooms than did low efficacious teachers. Of the two groups, the highly efficacious teachers were also more likely to overcome instructional setbacks. In addition, the teachers with a high teaching self efficacy could have implemented more open-ended, student directed teaching strategies in their classrooms than did the teachers with a low teaching self efficacy.

Consistent with Ross' (1994) study on teaching self efficacy, highly efficacious teachers were also more likely to:

- Exhibit management strategies that facilitate students' math achievement;
- Place continuous emphasis on differentiated math instruction for students;
- Inspire students to develop positive self esteem for learning mathematics; and
- Show students how to set continuous goals for mathematical achievement.

We conclusively suggest that the highly efficacious teachers may have spent more time on planning and organization for mathematical teaching. Our inferences are grounded on the notion that both groups of teachers taught African American, Caucasian American, and Hispanic American students. But regardless of the students' ethnicity, the teaching self efficacy had the same impact on the respective group of students. Better stated, highly efficacious teachers yielded similarly high test scores among students. Low efficacious teachers produced similarly moderate to low test scores among their students. Thus, drawing upon these explanations, We support the statistically significant differences in the test scores for students with highly efficacious teachers and students

with low efficacious teachers.

Implications

The main implications from this study are twofold. First, the middle school administration for the targeted study must provide math teachers with systemic staff development regarding mathematics instruction. This implications is supported by past research regarding the strong correlation between professional development and raised teacher self efficacy (Bredeson & Scribner, 1996; Sparks, 1986). They are also congruent to this research's indication of how professional development indirectly impacts student achievement. Based on this research, we believe that the staff development model should:

- Consist of and engage teachers in math topics and tasks that reflect their work and concerns about teaching math to students;
- Facilitate opportunities for teachers to ask questions about the issues and strategies that impair and enhance, respectively, their teaching practices;
- Provide teachers with the opportunities to observe, experiment with, and reflect on various mathematical strategies; and
- Show teachers how their acquisition of these strategies meet the school's overall plan for addressing the instructional needs of students.

These strategies are inclusive of Bandura's (1977, 1986) theory on raising self efficacy through verbal persuasion and vicarious experiences.

The second implication lies in the principals' direct support for these experiences. They must support the math teachers' implementation of staff development strategies into the classrooms. One strategy is to provide teachers with ample time to discuss and plan strategies for incorporating the staff development recommendations into their teaching. Along those same vicarious lines, principals should make arrangements for the teachers to observe each other's use of the strategies in their classrooms. This strategy could be especially beneficial to low efficacious math teachers.

Another significant strategy would be to provide teachers with the resources needed to build their confidence for teaching students. Third, principals should make daily observations of the math classrooms. During post observation conferences, the teachers should receive attributional feedback and effort feedback about their performance (Pintrich & Schunk, 1996). Equally significant, the principals should create regular opportunities to engage teachers in joint decision making regarding the students' mathematical needs. Finally, the teachers should receive release time to travel to math conferences. These conferences could serve as an extended professional development for the teachers.

Consistent with Bandura's (1977, 1986) social cognitive theory, these strategies could create an instructional climate that causes the teachers to re-evaluate and self-regulate their confidence to effectively teach math students. The self perceived confidence could be a stronger predictor of effective math teaching than the teachers' actual ability to teach mathematics. As denoted in Bandura's triadic causal model, the translation of the confidence into actual ability is contingent upon three factors: Personal

factors, behavior, and environment. If the staff development activities and principal support facilitate student achievement, the teachers may develop more positive expectations from their teaching. We believe that the highly efficacious teachers would mostly use this environment to reaffirm their teaching practices. In particular, they would use the environment to maintain their strong sense of self efficacy for mathematical teaching. The teachers with a low self efficacy, however, could gain even more benefits from this environment than the highly efficacious teachers. In our opinion, these teachers could return to their classrooms with new insight and strategies for effective mathematical teaching. Most important, they could develop a higher level of self efficacy to facilitate high student achievement. Collectively, both groups of teachers would realize that their expectations for mathematical achievement could have a positive effect on the learning tendencies of students. Most important, their self efficacy could have a direct impact on closing the ethnic achievement gap among their students.

Limitations

This study should be interpreted with consideration to several limitations. First, the small sample indicates that the findings may only be generalizable to rural middle schools in southeast Texas. In addition, the findings may only be applicable to seventh grade math students in this region. Therefore future research should entail a replication of this study in urban middle schools, elementary schools, and high schools. The second limitation is the lack of content specificity for the teacher self efficacy scale. We complied with Bandura's (1977, 1986) recommendation of measure domain specific competency of the math teachers. However, we did not adhere to his recommendation of ensuring that the scale has context specificity. The reason is that we believe that such content specificity would be a time consuming and unattractive task. Furthermore, we believe that the modified self efficacy scale would indicate teacher's overall confidence in teaching seventh grade math to students. Notwithstanding, readers should use some level of caution for interpreting teacher self efficacy's influences on this study. The final and most important limitation is that we did not investigate the effects of student self efficacy on the ethnic differences in benchmark tests. Much research has shown that student self efficacy impacts student achievement (Marsh, Walker, & Debus, 1991; Schunk, 1994; Zimmerman, Bandura & Martinez-Pons, 1992). Thus, this variable may have contributed to the outcomes of this study.

Future Research Directions

The findings from this study warrant the need to conduct future research on self efficacy and the achievement gap. One area of future research is the interaction between the study variables and the achievement gap in course selection and graduation rates. Other areas to be considered are differences in pass/fail rates among Caucasian American, African American, and Hispanic American students.

In addition, research should focus on the impact of the study variables on other academic subjects. Self efficacy is still a relatively new predictor of performance in various academic domains (Marsh, Walker, & Debus, 1991; Schunk, 1994; Zimmerman, Bandura & Martinez-Pons, 1992). Therefore, researchers should attempt to learn more about the interactive effects of race and teacher self efficacy on achievement differences in English, reading, science, social studies, writing, and computer technology. Such research would provide a more holistic view on how self efficacy impacts student achievement.

Finally, future research should consider the achievement gap in accordance to the study variables' interaction with other student and teacher characteristics. Specifically, the achievement gap could be explained by the study variables' interaction with teacher expectations, teacher experience, and teacher certification. Additional characteristics to be considered are gender, socioeconomic status, and academic background.

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Appendix A

Mathematics Teacher Self-Efficacy Scale

Please use the following scale to rate your level of confidence for teaching mathematics.

Scale

1=Not Confident 2=Not Really Confident 3=Somewhat Confident
4=Confident 5=Very Confident

How confident are you in your abilities to.....

- | | | | | | |
|---|---|---|---|---|---|
| 1. Use class size as a strategy for maintaining an effective mathematic learning environment? | 1 | 2 | 3 | 4 | 5 |
| 2. Teach any math concept to the most difficult students? | 1 | 2 | 3 | 4 | 5 |
| 3. Prevent administrative paperwork from having a negative impact on your energy for teaching Math to students? | 1 | 2 | 3 | 4 | 5 |
| 4. Inspire students to learn math when there is lack of support from the home? | 1 | 2 | 3 | 4 | 5 |
| 5. Keep students focused on difficult math assignments? | 1 | 2 | 3 | 4 | 5 |
| 6. Increase students' memory of previously taught mathematics lesson? | 1 | 2 | 3 | 4 | 5 |
| 7. Motivate students who show lower interest in schoolwork on mathematics? | 1 | 2 | 3 | 4 | 5 |
| 8. Facilitate the creation of cooperative math learning groups? | 1 | 2 | 3 | 4 | 5 |
| 9. Help students overcome the influence of school wide conditions that may negatively impact their motivation for learning? | 1 | 2 | 3 | 4 | 5 |
| 10. Help students overcome the influence of home/community conditions that may negatively impact their motivation for learning? | 1 | 2 | 3 | 4 | 5 |

11. Get children to complete their homework?	1	2	3	4	5
12. Create classroom rules and procedures that promote a safe and orderly learning environment?	1	2	3	4	5
13. Control disruptive behavior in the classroom?	1	2	3	4	5
14. Get children to assume some responsibility for managing their classroom behavior?	1	2	3	4	5
15. Prevent major behavioral disruptions in the classroom?	1	2	3	4	5
16. Convince parents to take interest in their children's progress on math objectives for your class?	1	2	3	4	5
17. Provide parents with meaningful strategies for helping their children to make mathematical achievements?	1	2	3	4	5
18. Make parents feel comfortable with visiting your classroom?	1	2	3	4	5
19. Help parents to feel comfortable with talking with you?	1	2	3	4	5
20. Make the classroom a safe place for learning mathematics?	1	2	3	4	5
21. Influence students to look forward to coming to math class?	1	2	3	4	5
22. Get students to trust you?	1	2	3	4	5
23. Convince students to believe that they are high math achievers?	1	2	3	4	5

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